

**WHAT IS CLAIMED IS:**

1. A maintenance system for an optical switch fabric in an optical network through which an optical traffic signal is conveyed via an optical traffic channel, said maintenance  
5 system comprises:

a generator for generating an optical test signal;

a multiplexer for optically multiplexing said test signal with said traffic signal to form a composite signal, said composite signal being conveyed through said switch fabric via said optical traffic channel;

10 a demultiplexer for optically demultiplexing said composite signal into said test signal and said traffic signal after it comes out from said switch fabric;

means for measuring quality of said test signal and said traffic signal output from said demultiplexer.

15 2. The maintenance system of claim 1 further comprises means for sending a sample probe signal representing said demultiplexed traffic signal to said quality measuring means.

3. The maintenance system of claim 1 further comprises means for receiving and analyzing said measured quality of said demultiplexed test and traffic signals so as to determine a fault source when said demultiplexed traffic signal is found to be defective.

20 4. The maintenance system of claim 1 further comprises means for further transmitting said demultiplexed traffic signal to its destination along said traffic signal channel.

5. The maintenance system of claim 1 further comprises means for dropping said demultiplexed test signal.

6. The maintenance system of claim 1 wherein said quality measuring means is one or more optical performance monitors.

7. The maintenance system of claim 1 wherein said generator generates said test signal only when there is a live optical traffic signal.

8. The maintenance system of claim 1 wherein said switching fabric conveys said composite signal according to addressing information of said traffic signal.

9. The maintenance system of claim 1 further comprises a splitter for splitting said multiplexed composite signal into two divided composite signals.

10. The maintenance system of claim 9 further comprising means for conveying said two divided composite signals through said switch fabric via two separate traffic signal channels.

11. The maintenance system of claim 9 wherein each of said two divided composite signals are demultiplexed, after leaving said switch fabric, into said divided traffic signal and test signal respectively.

12. The maintenance system of claim 11 further comprising a selector for selecting, in response to result from said quality measuring means, one of said two traffic signals to send to its destination.

13. The maintenance system of claim 1 further comprising means for dynamically selecting an input port and an output port of said switch fabric when there is no live optical traffic signal, forming an internal test channel of said switch fabric.

14. The maintenance system of claim 13 further comprising means for shifting said test signal to said multiplexer if there is a live traffic signal, and to said test channel if there is no live traffic signal.

15. A method of maintenance for an optical switch fabric in an optical network through which an optical traffic signal is conveyed via an optical traffic channel, comprising the steps of:

generating an optical test signal;

when there is an incoming optical traffic signal, optically multiplexing said test signal with said incoming traffic signal to form a composite signal;

conveying said composite signal via said optical traffic channel through said

5 switch fabric;

optically demultiplexing said composite signal output from said switch fabric into said test signal and traffic signal; and

measuring quality of both said demultiplexed test signal and traffic signal.

16. The method of claim 15 wherein said measuring quality of said demultiplexed traffic signal is implemented by measuring a sample probe signal representing said demultiplexed traffic signal.

17. The method of claim 16 wherein said measuring comprises a step of extracting said sample probe signal from said demultiplexed traffic signal.

18. The method of claim 15 wherein said generating is carried out only when there is a live traffic signal.

19. The method of claim 15 further comprising a step of analyzing results of said measuring step so as to determine a possible fault source if said demultiplexed traffic signal is found to be defective.

20. The method of claim 15 further comprising a step of dropping said demultiplexed test signal and transmitting said demultiplexed traffic signal further to its destination along said traffic channel.

21. The method of claim 15 wherein said generating is implemented by a test signal generator.

22. The method of claim 15 wherein said measuring is implemented by one or more optical performance monitors.

23. The method of claim 15 further comprising a step of, when there is no incoming optical traffic signal, dynamically selecting an input port and an output port of said switch fabric to form an internal test channel.

24. The method of claim 23 further comprising steps of:  
transmitting said test signal through said internal test channel when there is no incoming traffic signal; and

measuring quality of said test signal output from said switch fabric through said internal test channel so as to determine whether said internal test channel works properly.

25. A maintenance system for an optical switch fabric through which an optical traffic signal is transmitted via an optical traffic channel, said maintenance system comprises:

generator for generating a test signal;  
means for selecting an input port and an output port of said switch fabric, forming an internal fabric test path to be measured;  
means for transmitting said test signal through said test path; and  
means for monitoring quality of said test signal after it comes out from said switch fabric through said test path so as to determine whether said test path works properly.

26. The maintenance system of claim 25 wherein said selected ports are unused ports when there are live signals being carried through said switch fabric.

27. The maintenance system of claim 25 wherein said generator generates said test signal dynamically.

28. The maintenance system of claim 27 wherein said generator generates said test signal on a periodical basis.

29. The maintenance system of claim 25 wherein said means for selecting selects said ports according to a predetermined priority scheme.

5 30. A method of maintenance for an optical switch fabric in an optical network, comprising the steps of:

generating a test signal;  
selecting a test channel comprising an input port and an output port of said switch fabric;  
transmitting said test signal through said test channel; and  
10 measuring quality of said test signal outcome from said output port to monitor whether said test channel works properly.

31. A method of maintenance for an optical network switch fabric, comprising the steps of:

generating a test signal;  
15 selecting between a real-time maintenance mode and a background maintenance mode;  
in said real-time maintenance mode:  
optically multiplexing said test signal with an incoming traffic signal being transmitted through a traffic channel to form a composite signal;  
transmitting said composite signal over said traffic channel through said switch  
20 fabric;  
optically demultiplexing said composite signal after it leaves said switch fabric into said test signal and said traffic signal;

measuring quality of both said demultiplexed test and traffic signals so as to monitor performance of said traffic channel;

in said background maintenance mode:

selecting a test channel comprising an input port and an output of said switch fabric;

transmitting said test signal via said test channel through said switch fabric; and

measuring quality of said test signal output from said switch fabric to monitor performance of said test channel.

32. The method of maintenance of claim 31 wherein said step of selecting between said two maintenance modes comprising a step of shifting between said two modes.

33. The method of maintenance of claim 31 wherein said real-time maintenance mode is selected when an optical traffic signal is found to be defective.

34. The method of maintenance of claim 31 wherein said real-time maintenance mode is always selected when there is a live optical traffic signal.

35. The method of maintenance of claim 31 wherein, in said background maintenance mode, said selected ports forming said test channel are not being used by any live traffic signal.

36. An optical network switching system comprising:

a switch fabric for conveying an incoming optical traffic signal to its destined output of said switching system via a traffic channel;

an input module for receiving said incoming optical traffic signal and forwarding it to said switch fabric;

an output module for receiving said optical traffic output from said switch fabric and forwarding it to said output destination of said switching system;

wherein said input module comprises:

a generator for generating a test signal;

means for multiplexing said test signal with said incoming traffic signal to form a composite optical signal which is transmitted to said switch fabric via said traffic channel;

wherein said output module comprises:

means for demultiplexing said composite optical signal conveyed by said switch fabric into said test signal and traffic signal; and

means for measuring quality of both said demultiplexed test signal and traffic signal.

37. The system of claim 36 wherein said input module further comprises a splitter for splitting said composite signal into two divided composite signals and forwarding them to said switch fabric via two separate traffic channels.

38. The system of claim 37 wherein said demultiplexing means in said output module is capable of receiving said two divided composite signals via said two separate traffic channels and demultiplexing each of said two composite signal into said test signal and traffic signal respectively.

39. The system of claim 38 wherein said output module further comprises means for sending a sample probe signal from each said demultiplexed traffic signals to said quality measuring means.

40. The system of claim 39 wherein said output module further comprises means for sending said two demultiplexed test signals to said quality measuring means.

41. The system of claim 38 wherein said output module further comprises a selector for receiving said two demultiplexed traffic signals as well as measurement results associated with said two demultiplexed traffic signals from said quality measuring means, and for selecting one of said two demultiplexed traffic signals to send to said output destination in according to  
5 said measurement results.

42. The system of claim 41 wherein said selector also receives said two demultiplexed test signals for analyzing performance of said two traffic channels.